Astrobee: Autonomous free flying robots for the ISS

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Science Fiction Inspires Real Science

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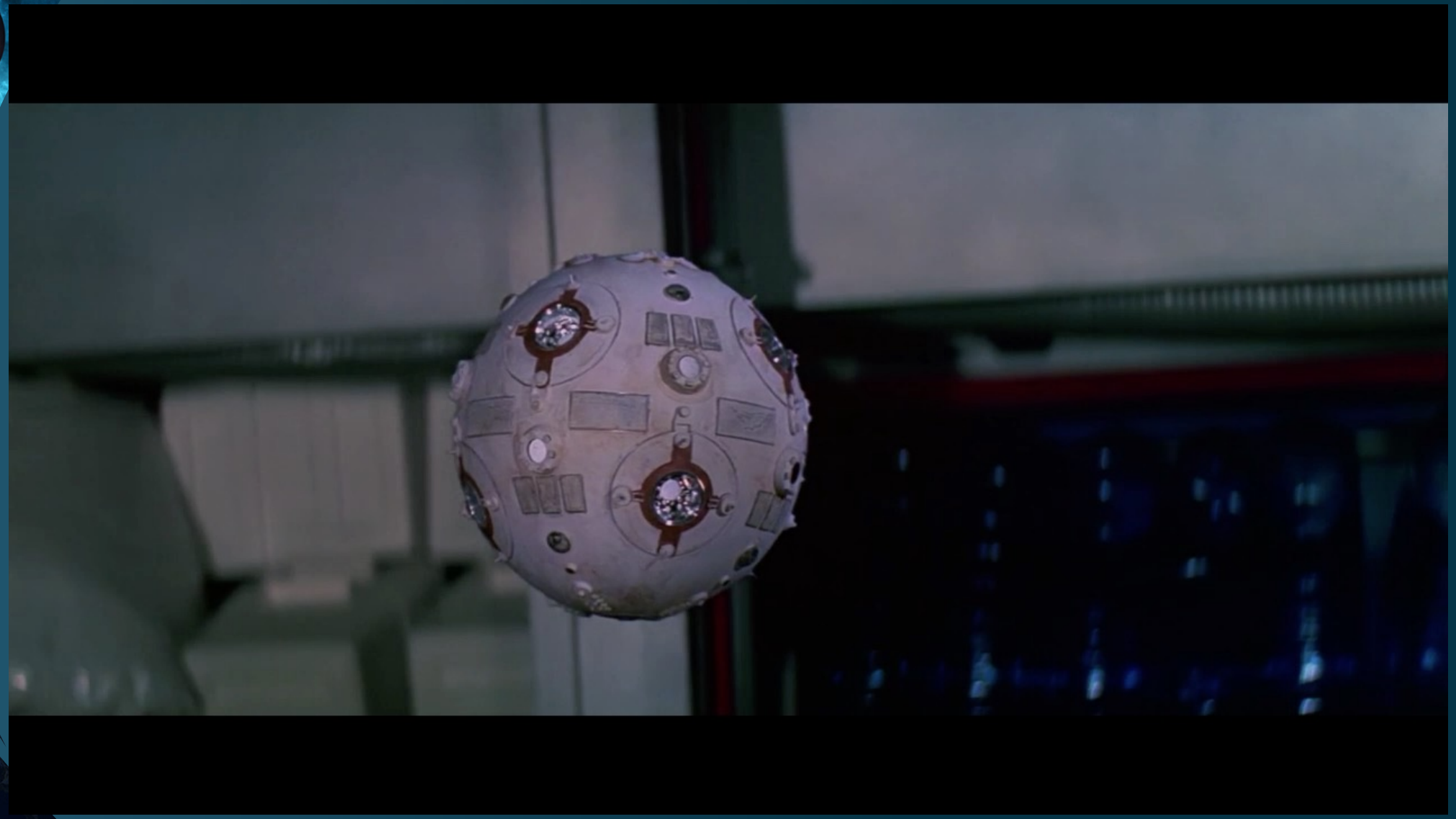
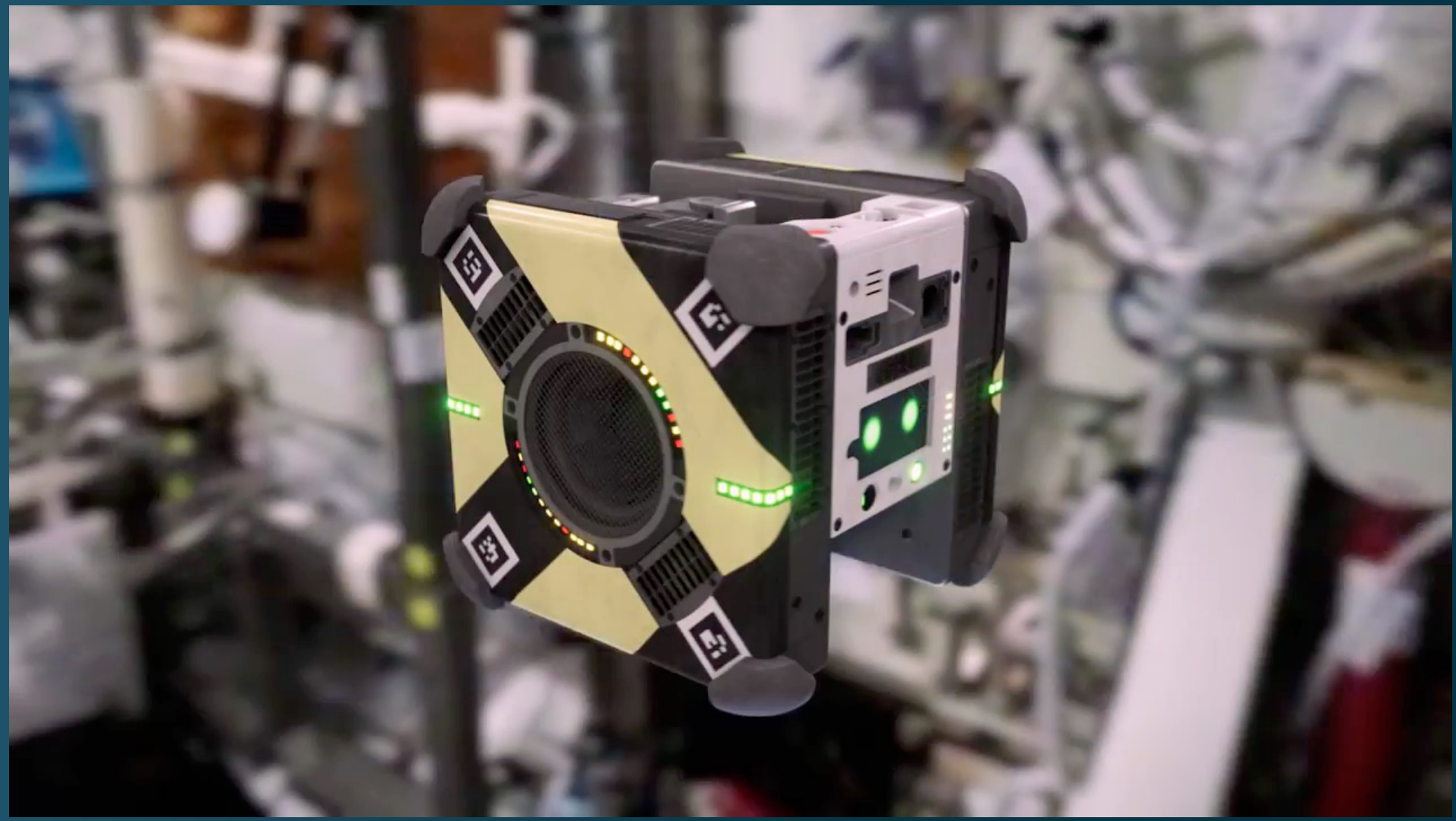
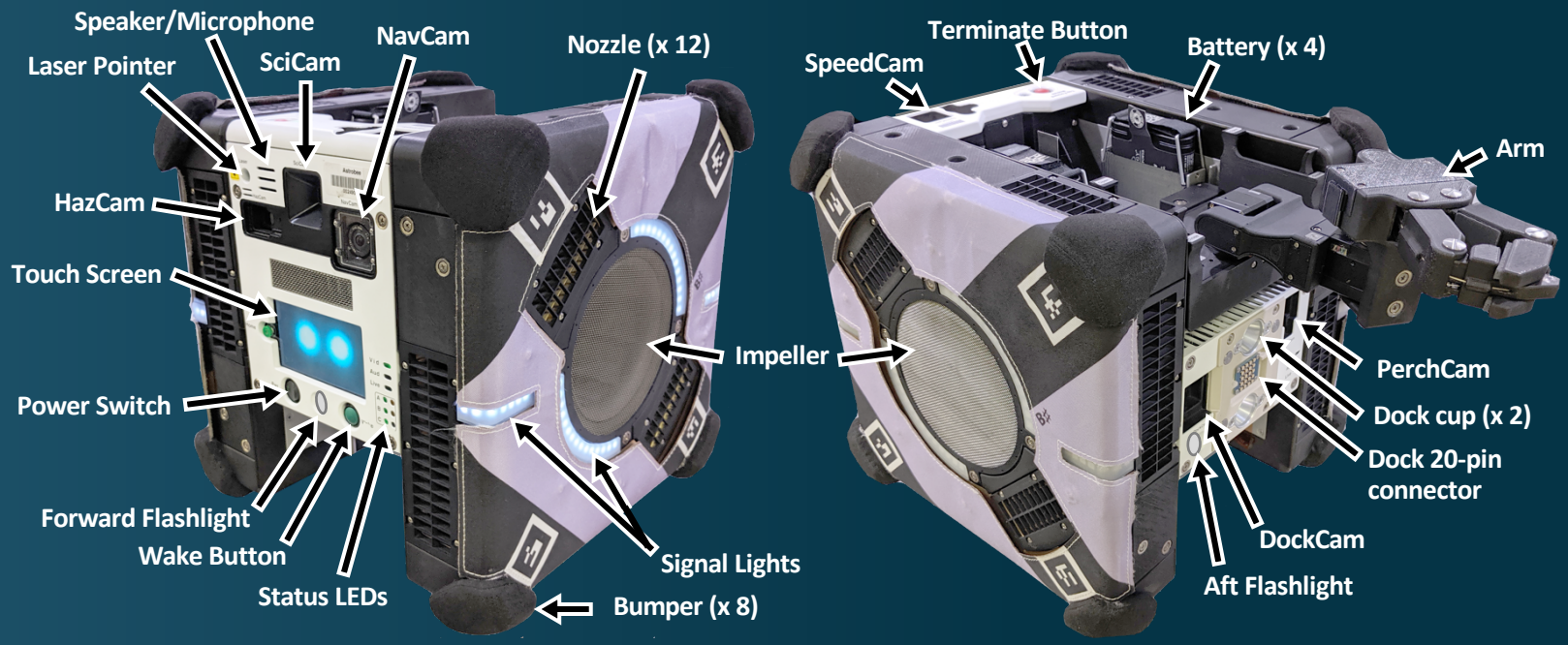


MIT
NASA ARC
AURORA DARPA
SPHERES

Astrobee on the ISS



Astrobee free flyer



1. Provide a **<u>microgravity robotic research facility</u>** in the ISS, which will replace the existing SPHERES facility
2. Provide **<u>remotely operated mobile camera</u>** views of the ISS to enhance the situation awareness of mission control
3. Perform **<u>mobile sensor tasks</u>** in the ISS

Astrobee Guest Science Payloads

Guest Science: JSC REALM RFID tag reader

30-0662: WHC Pre-Treat Tank (E-K) Wanted Poster
Page 1 of 1

WANTED

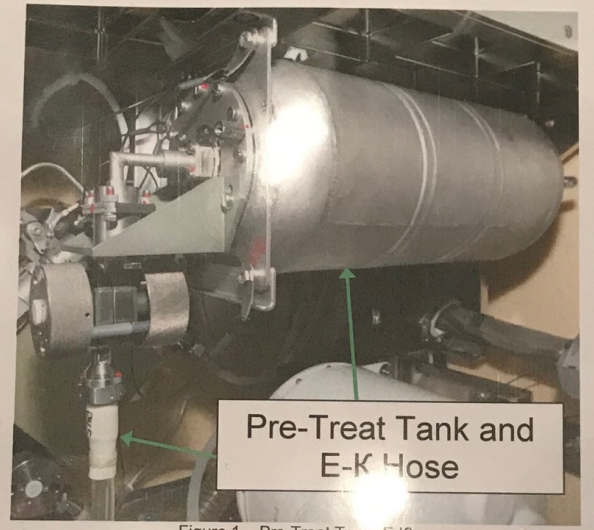


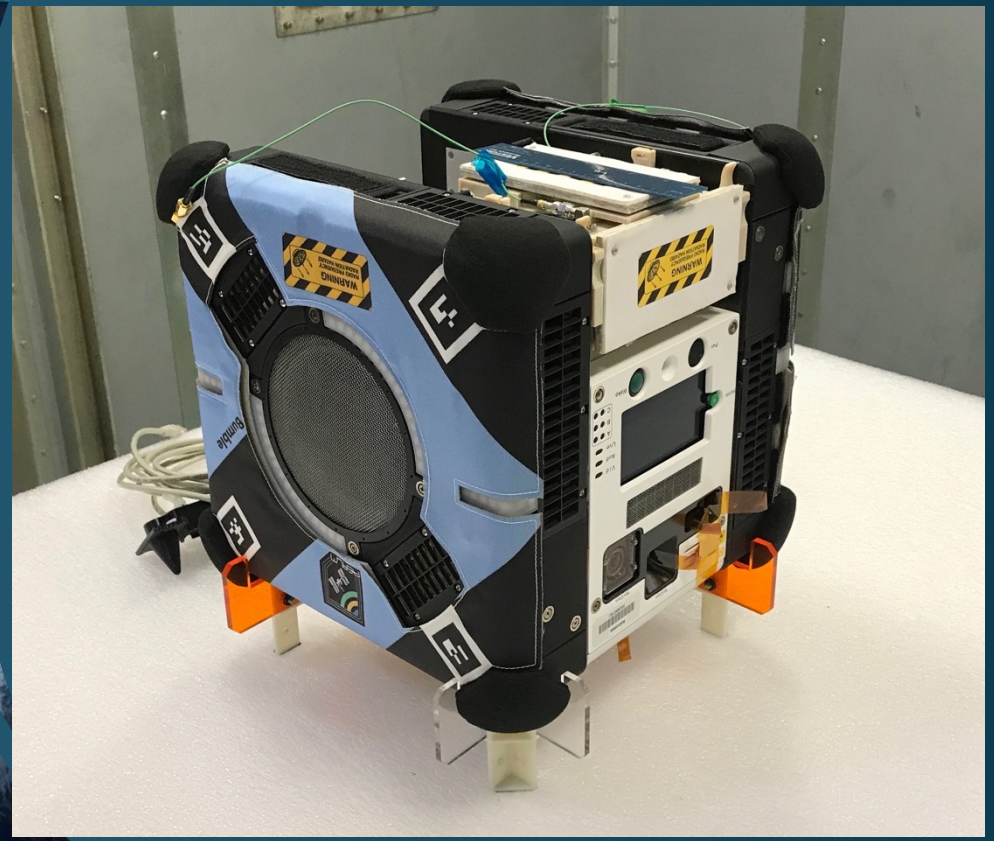
Figure 1 – Pre-Treat Tank (E-K)

...nd report location to MCC-H.

Identification:
Part Name: **Pre-Tank (E-K)**
Part Number: **10146.4267.000-01**
Serial Number: **809048**
Barcode: **00142920J**

Guest Science: JSC REALM RFID tag reader

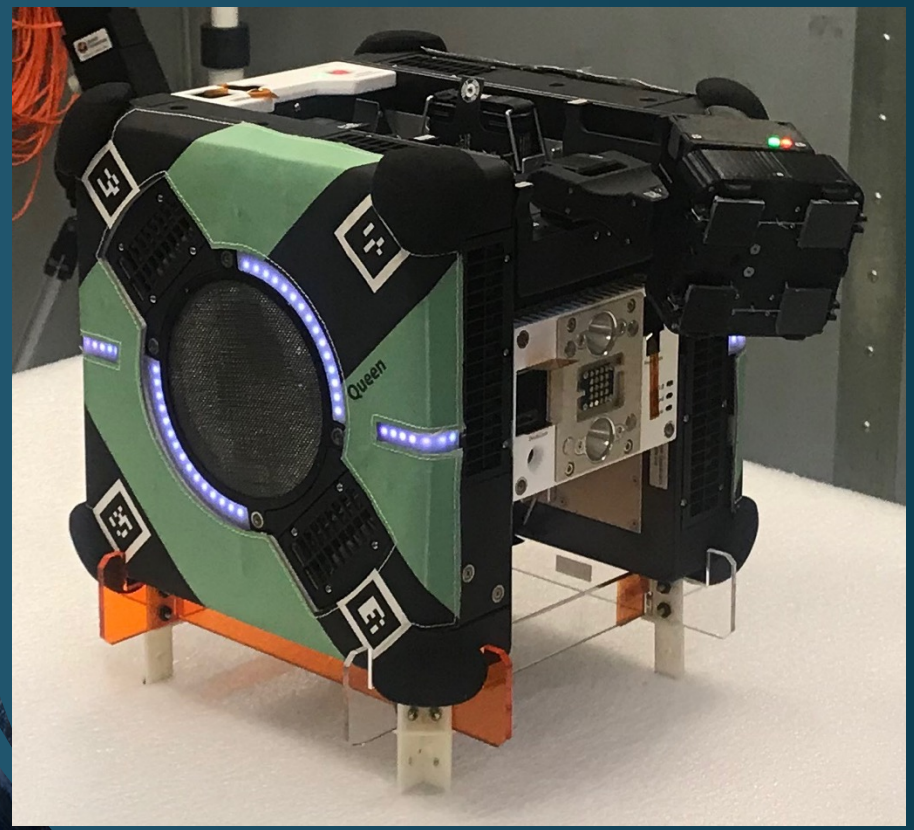
- RFID reader allows inventory and searches for logistics reduction
- Launching on NG-12

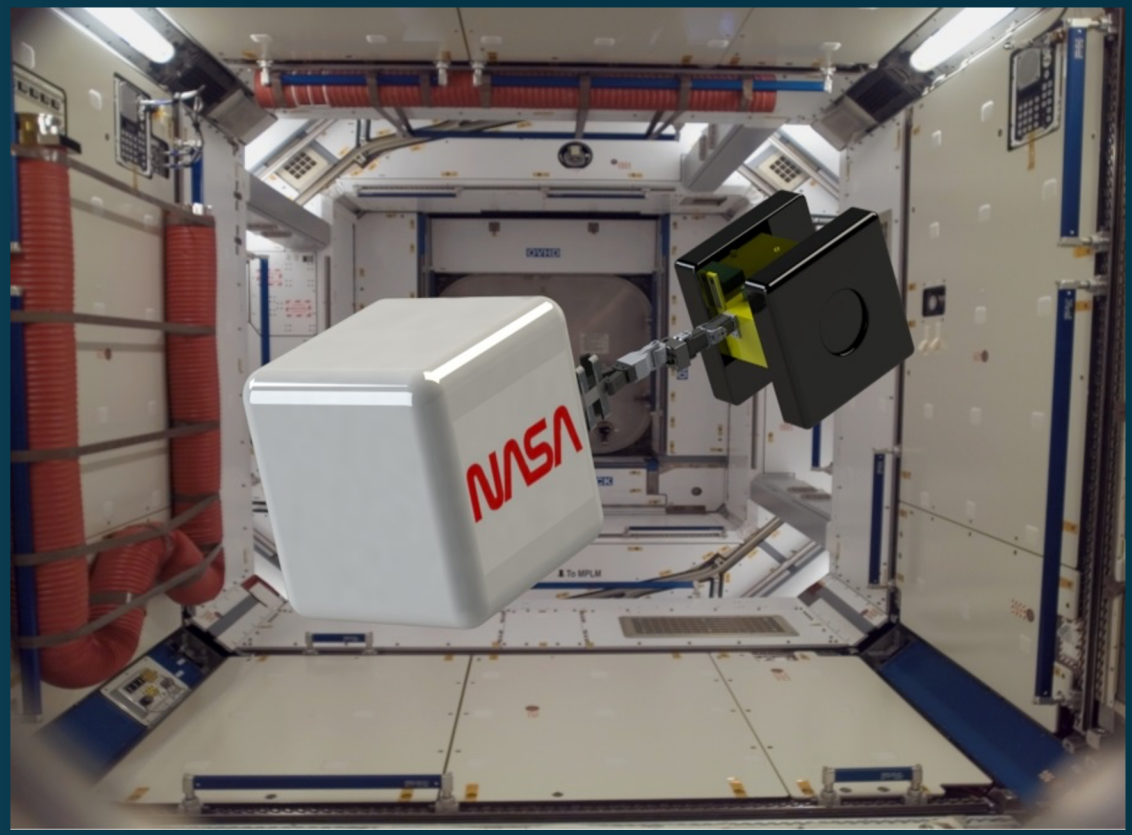


Credit: NASA JSC

Guest Science: Stanford Gecko Adhesive Gripper

- Gecko-inspired end-effector for gripping of smooth surfaces
- Launched in 2019



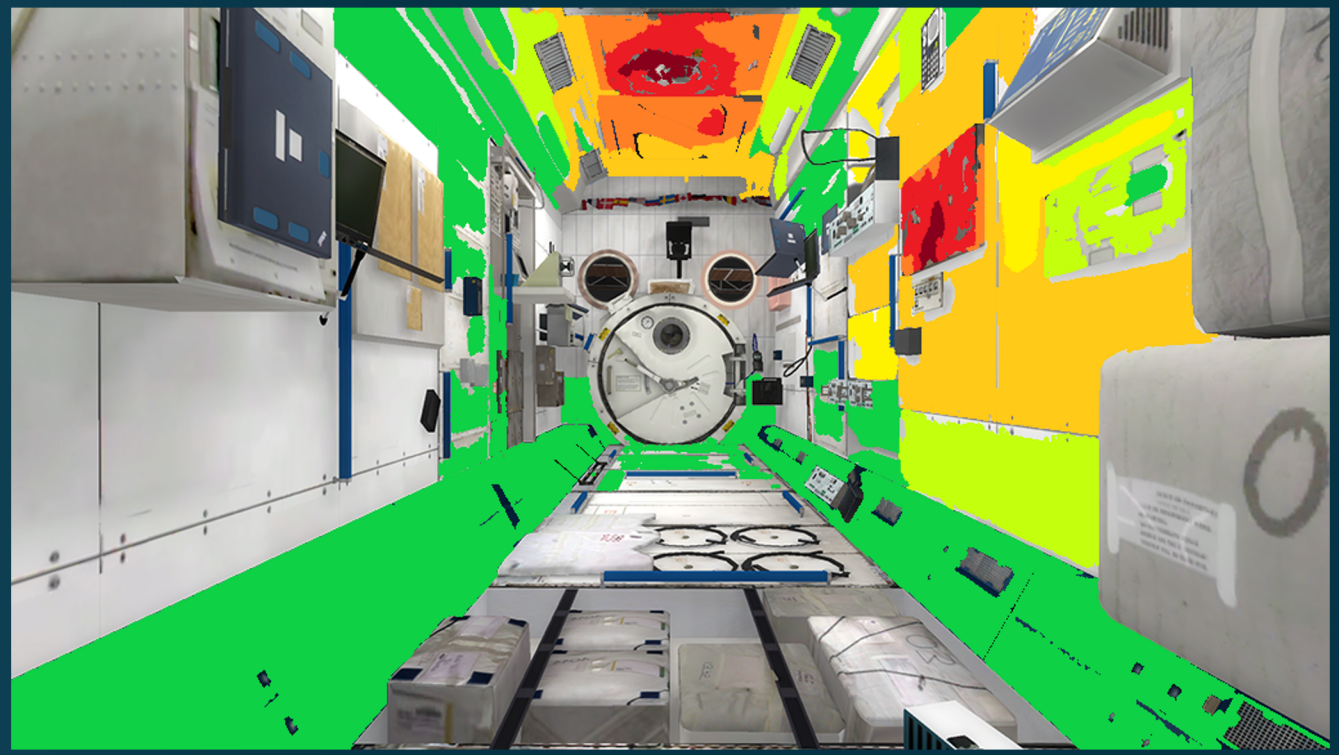


Credit: Stanford

Guest Science: Astrobotic SoundSee

- Microphone array that creates a sound map used to monitor health of on-board systems
- Launched in 2019

SoundSee payload



Heat maps

Credit: Astrobotic/BOSCH

Astrobee Status

Fleet of AstroBees

Dock Station and 3 Astrobees onboard the ISS.

- **Bumble**
- **Honey** (down for repair)
- **Queen**

Bsharp and WannaBee
at NASA Ames.

ISAAC Camera survey

Future tasks

Astrobee will help prove out the concept of "Caretaker Robots" for future Intra-Vehicular Robotic (IVR) exploration (Lunar Gateway).

Monitor the environment

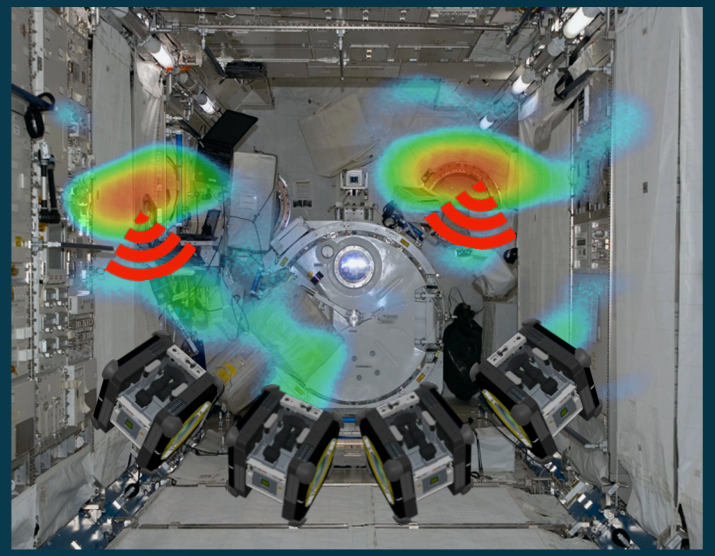
- Ensure crew health and safety
- Maintain vehicle health and longevity
- Sound levels, radiation, air quality

Inspection functions can include:

- Spot checks
- Surveys (RFID localization)
- Localizing problems

With dexterous robotic manipulation, future tasks could include:

- Maintenance
- Repair
- Cargo transfer



NASA Astrobee Game

Zero Robotics student competition

Conclusions

Astrobee will allow guest scientists to test new technologies on the ISS

Improves crew safety, by monitoring the environment

A lot of uses and tasks to help astronauts (essential for future long term Space Exploration)

Currently **Bumble and Queen** on the ISS.

Dozens of guest science ISS experiments in progress

Thanks very much for the attention!

Fun with Robots

Any questions?